A Study on the Development of an Algorithm of AI in the Prediction of Sustainable Development of a Nation

UNIVERSITY LOGO

A Synopsis
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1. Introduction

Sustainability is the ability to exist and develop without depleting natural resources for the future. Sustainable Development Goals (SDGs) are a set of 17 Goals adopted by 193 member countries of the United Nations at the historic Summit held in New York on 25 September 2015. Came into force on 01 January 2016, the SDGs are expected to stimulate development actions in areas of critical importance such as ending poverty and hunger, providing healthy lives and quality education, achieving gender equality, providing modern energy, promoting sustainable economic growth, reducing inequalities till the year 2030. Also known as the 2030 Agenda for Sustainable Development, the SDGs aim at transforming the lives and livelihood of the people across the globe. The United Nations defined sustainable development in the Brundtland Report as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It assumes that resources are finite, and so should be used conservatively and carefully to ensure that there is enough for future generations, without decreasing the present quality of life.

The variables that are implicit in Sustainable Development are usually presented in the form of a triangulation that, according to and Higgins, should respect the 3 main pillars of Sustainable Development:

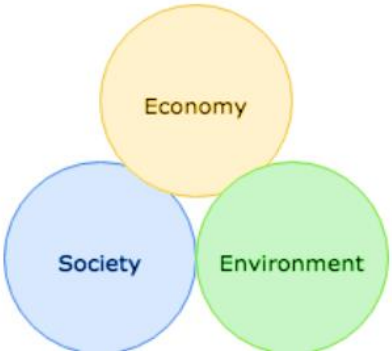


Figure 1: Triangulation of Sustainable Development

Artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience. At present, Artificial Intelligence has become a mature scientific discipline and technology that has expanded beyond laboratories to the entire society. Both industry and government administrations

are increasingly utilizing intelligent and digital technologies in their daily projects and endeavors. Artificial intelligence (AI) has become a vital technology in solving contemporary challenges in business, politics, and personal life. Its emergence has brought about a positive transformation in various sectors. AI is projected to have a significant impact on global productivity, equality, inclusion, environmental outcomes, and other areas, both in the short and long term. Their main function is to act in the physical or digital world by acquiring data, interpreting it, reasoning, and processing information to achieve a given goal. These systems may use symbolic rules or numerical models, and they can alter their actions based on past decisions and their impact on the environment. According to definition by Vinuesa et al. (2020), who consider AI to be: any software technology with at least one of the following capabilities: perception—including audio, visual, textual, and tactile (e.g., face recognition), decision-making (e.g., medical diagnosis systems), prediction (e.g., weather forecast), automatic knowledge extraction and pattern recognition from data (e.g., discovery of fake news circles in social media), interactive communication (e.g., social robots or chat bots), and logical reasoning (e.g., theory development from premises). This view encompasses a large variety of subfields, including machine learning and deep learning.

Recent advances in ML have increased the capabilities of data-driven modeling (DDM), which allows AI to predict a system's behavior by computing and exploiting correlations between observed variables within it (Willcock et al., 2018). Using ARIES (AI for Ecosystem Services), Algorithms can facilitate to utilization available data and contribute to the need for ecosystem service models at multiple scales, analyzing and forecasting concerns with these services across disaggregated beneficiaries (Valeev et al., 2020; Willcock et al., 2018). The DDM samples were created using the Weka and ARIES software, that is, firewood consumption in South Africa and biodiversity value in Sicily, respectively. DDM (64%–91% accuracy) can identify places where firewood consumption is among the top quartile with comparable accuracy to traditional modeling approaches (54%–77% accuracy), as shown in their South African study.

1.1 Sustainable Development Goals

In 2015, the 193 countries that make up the United Nations (UN) agreed to adopt the 2030 Agenda for Sustainable Development. The historic agenda lays out 17 Sustainable Development Goals (SDGs) and targets for dignity, peace, and prosperity for the planet and humankind, to be completed by the year 2030. The agenda targets multiple areas for action, such as poverty and sanitation, and plans to build up local economies while addressing people's social needs.

From a sustainable development perspective, there are 17 goals are described in below.

Goal 1: End poverty in all its forms everywhere.

Goal 2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.

Goal 3: To ensure healthy lives and promote well-being for all at all ages. The targets of SDG 3 focus on various aspects of healthy life and healthy lifestyle.

Goal 4: Ensure inclusive and equitable quality education and promote life-long learning opportunities for all.

Goal 5: Achieve gender equality and empower all women and girls.

Goal 6: Clean Water and Sanitation: Ensure availability and sustainable management of water and sanitation for all.

Goal 7: Affordable and Clean Energy: Ensure access to affordable, reliable, sustainable and modern energy for all.

Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Goal 10: Reduce inequality within and among countries.

Goal 11: Sustainable Cities and Communities: Make cities and human settlements inclusive, safe, resilient, and sustainable.

Goal 12: Responsible Consumption and Production: Ensure sustainable consumption and production patterns.

Goal 13: Take urgent action to combat climate change and its impacts.

Goal 14: Life Below Water: Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.

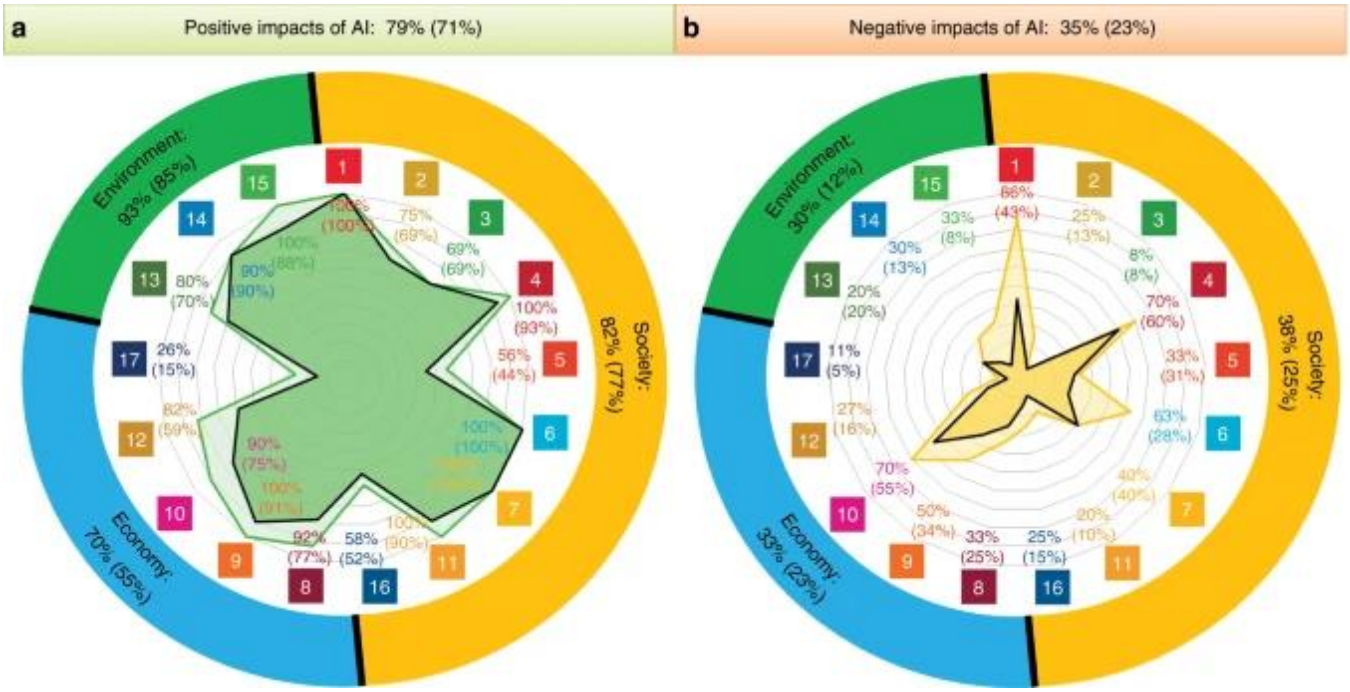
Goal 15: Life on Land: Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt

biodiversity loss.

Goal 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

Goal 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Fig. 2: Summary of positive and negative impact of AI on the various SDGs.[1]



2. Objectives of the Research Work

The main objective of this research was to understand what the role of Artificial Intelligence might be in achieving the SDGs.

To achieve the above objectives, the following sub goals are to be achieved:

1. Step-by-step analysis to simulate the goals of the SDG on AI
2. To review the existing literature of Artificial Intelligence for development and how they are being used for Sustainable Development purposes.
3. Inculcating simulations and studying real-time data of weather events for forecasting weather, climate science, signaling early warning and prioritizing responses
4. Analyzing the algorithms of machine learning for forecasting water quality index.

5. To improve agriculture's efficiency while lowering its carbon footprint and improving food production

2.1 RESEARCH HYPOTHESIS

1.Role of modelling in achieving sustainable development goals.

2.Strength, weakness, Opportunities and Threats of Artificial Intelligence for achieving SDGs.

3.Effect of AI to change the game in the field of air pollution.

4.To build a prediction model for effective water pollution control solutions

5.Use of digital technologies to improve agriculture's efficiency.

3. RESEARCH METHODOLOGY

Data collection the pipeline begins with gathering relevant data to train and evaluate the AI model. It can come from various sources, such as databases, APIs, sensors, or human-generated annotations.

Data preprocessing Data often needs to be preprocessed, cleaned, and normalized to prepare it for training before it is input into the AI model.

Feature engineering It involves extracting, selecting, or creating relevant data features to help the AI model learn patterns and make more accurate predictions. This step may involve domain expertise, statistical analysis, or automated feature selection techniques.

Model development The AI model architecture and algorithm are selected in this stage based on the specific problem. Development can involve choosing from statistical models, machine learning algorithms, or deep learning architectures. The model is then trained using the prepared data.

Model evaluation the performance and generalization capabilities of the trained model are

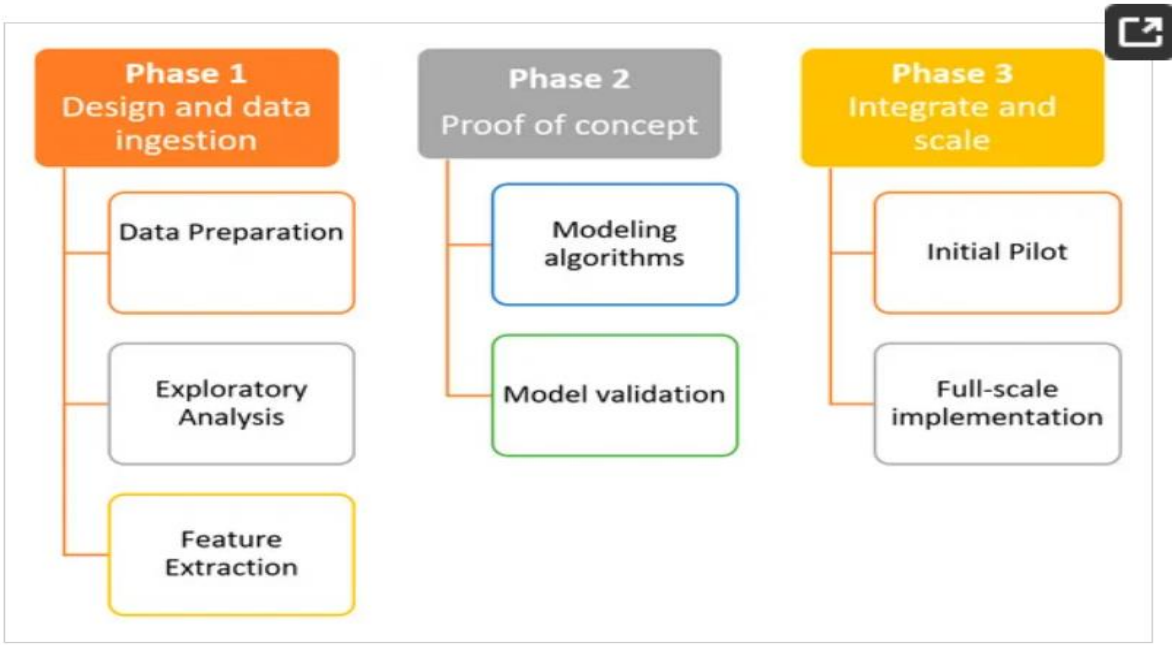
evaluated according to various metrics depending on the task, such as accuracy, precision, recall, F1 score, or area under the curve (AUC). Cross-validation or hold-out validation sets are often used to estimate the model's performance.

Model optimization If the model does not meet the desired performance criteria, it can be optimized with hyperparameter tuning, model architecture adjustment, or regularization techniques to improve its performance.

Deployment and integration Once it have reached satisfactory capabilities, including considerations of scalability, reliability, security, and monitoring, the model can be deployed into the production environment. Deployment involves integrating the model into a larger system or application, often using APIs or microservices.

Monitoring and maintenance After deployment, the AI system must be monitored to ensure continued performance and reliability. This includes monitoring data draft, model performance degradation, and handling updates or retraining as new data becomes available.

3.1 Proposed model



Three-Phases Approach to develop advanced predictive model—adapted from [10]

4. Literature survey

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2. Hollingsworth, 2019, Pascus, 2019 states that Climate change is recognized as "one of the foremost challenges" in the 2030 agenda, a perspective that reflects the scientific community's concern that climate change now poses an "enormous risk" to civilization.
3. Clutton-Brock et al., 2021states that by enhancing the accuracy of climate forecasting models, machine learning (ML)algorithms will progressively assist to prevent and mitigate the risk related to climate change in the next generation, namely, cyclone, typhoon, lightning, and thunderstorm.
4. Hussein et al., 2021states that The AI is based on various applications for monitoring climate changes using several data sources, such as satellite images and/or instruments measurements in different stations. This data are used to create special predictive algorithms for climate modeling.
5. Ruiz-Real et al., 2020 states that The AI and based on analyzing the data of events and their correlation over time, and looking for relationships between events, which results in a general conclusion or deductive rules.
6. Evison and Gillham, 2019; Mehta, 2019 shows that AI has the potential to mitigate global GHG emissions by between 1.5% and 4%by 2030 in four major sectors including agriculture, energy, transport, and water, with the greatest impact on transport, an amount equivalent to 2.4 Giga-tons of CO2equivalent—the equivalent of Australia's 2030 annual emissions.
7. Modeling can be used to guide policy (Jones, 2021), as the modeling can predict the future of agricultural production under extreme weather conditions, such as drought, water shortage, and high temperature, as well as changing planting times and worst-case scenarios (Araya et al., 2017)
8. Korobitsyna et al., 2020 states that Global warming mitigation might take the form of implementing new technologies and renewable energy sources, upgrading outdated equipment to be more energy-efficient, or altering management or customer behavior.
9. Jung et al. (2021) focused on using recent technologies related to AI tools and remote sensing.

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